Radar Vision

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Through three years of funding, LLNL's Radar Vision Project has produced a prototype UWB electronically steerable array of radars capable of scanning an arbitrary volume in space in an arbitrary fashion.

Special Forces, DARPA, DOE, and the intelligence community have a need for the capability to "see" through walls and smoke. Law enforcement first responders, such as Special Weapons and Tactics (SWAT) teams, require a portable, affordable device that will provide them real-time, full motion images of a crime scene through exterior and interior building walls, and through smoke.

The ability to differentiate between perpetrators and victims, and to locate weapons is highly desirable. Ultrasound and ground penetrating radar (GPR) devices could be used to detect moving people behind certain types of indoor and outdoor walls; however, in general, some type of imaging system is needed to generate a 2- or 3-D map of the interior of a room to locate and discriminate multiple people, especially if they are not moving.

GPR is one of the most promising technologies for imaging through walls and finding obstacles through smoke. Nonetheless, in order to get a good quality image useful for shape recognition, an ultra-wideband (UWB) scanning radar system or an array of radars, with suitable imaging algorithms, is needed to obtain a high-resolution Synthetic Aperture Radar (SAR) image of the scene.

The Radar Vision Project system consists of four parts. First, there is an FPGA-based controller board (Fig.1), which calculates and stores all the delays necessary to beam-form on both transmit and receive. Second, there is an FPGA-based delay board which implements the delay for each transmitter/receiver channel. Third there are the actual micro-power impulse radar (MIR) transmitters and receivers. Finally, we have an automatic gain board, which compensates for attenuation through space on each received signal.

The system is capable of scanning 300 x 400 points in space at a rate of 1 frame/s; resolution in range is subcentimeter, while in the transverse direction it depends on the aperture of the array. With an array aperture of 1 m, this gives about a 10-cm transverse resolution. A sample setup is illustrated in Fig. 2, with the corresponding raw radar image in Fig. 3.

Based on FY01-FY03 work, this project has provided the groundwork for generating interest from external sponsors.

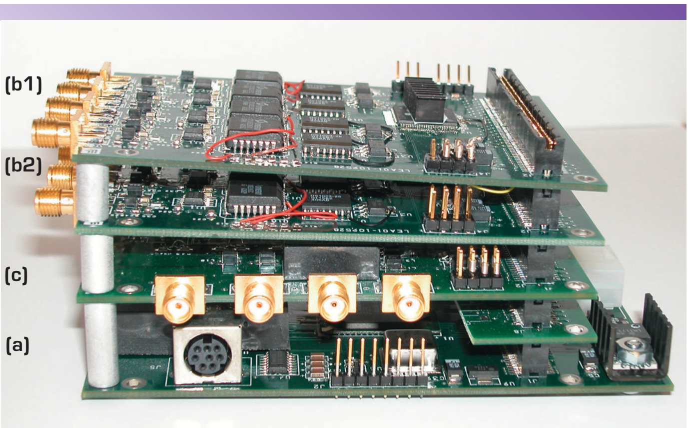

Figure 1. *(a) Controller board; (b) delay boards (4 ch/board); (c) gain board (4-ch/board).*

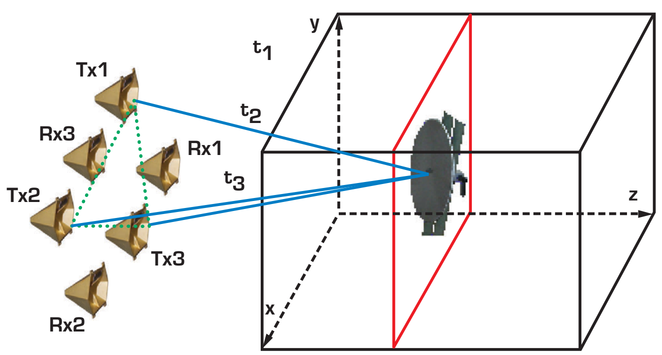

Figure 2. *Setup to scan a 30-cm round metal plate, through air at 2 m.*

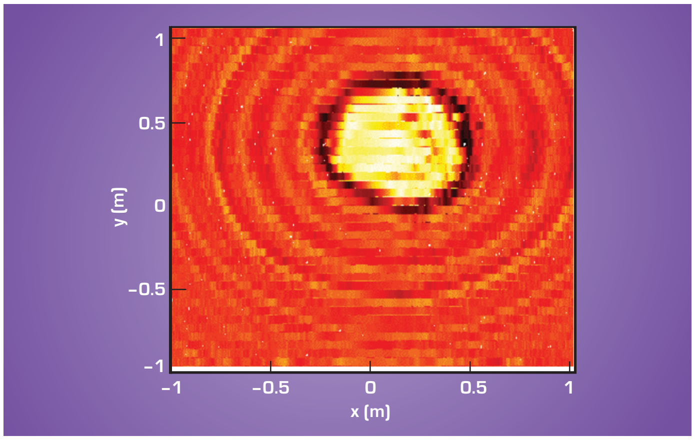

Figure 3. *Composite sum of radar returns from 30-cm round metal plate.*